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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/524,959	07/22/2005	Thomas Juestel	PHDE020192US	3623

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EXAMINER	
ELEY, JESSICA L	
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2884	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/524,959	JUESTEL ET AL.	
	Examiner	Art Unit	
	Jessica L. Eley	2884	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☐ Responsive to communication(s) filed on _____.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-5 and 7-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-5, 7-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 14 is objected to because of the following informalities: Claim 14 uses the phrase "wherein wherein" which is not conform to idiomatic English. Appropriate correction is required.

Claim 17 is objected to because of the following informalities: there is a period after "$0 \leq x \leq 1$." but the claim continues. Appropriate correction is required.

Also applicant cooperation is requested in correcting any errors of which applicant may become aware. Particularly with regards to the material "$Ca_{1-2y}Li_2SiO_4:Pr_yNa_y$." The specification notates this material as $CaLi_2SiO_4$:Pr,Na and $Ca_{0.98}Li_2SiO_4:Pr_{0.01},Na_{0.01}$ if a comma is needed for the claimed subject matter to appear as in the specification, it is kindly requested that applicant amend the claim to match the specification.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-4, 9, 11-16, and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Eijk et al (Van Eijk) Journal paper entitled "Nd^{3+} and Pr^{3+} Doped Inorganic Scintillators" and further in view of Boerner et al (Boerner) US 2001/0006214 A1.

Regarding claims 1, 2, 3, 4, and 9 it is held that Van Eijk teaches a device for the detection of input radiation comprising a Pr^{3+} activated scintillator (Table 2, page 666), converting input radiation into UV radiation (Table 2 and Figure 3) and a photodiode to convert the optical signal form the scintillator into an electrical signal (top of first column of page 665), wherein the scintillator is used in a PET or gamma camera (i.e. SPECT) imaging system (Table 1 and first column of page 664). Van Eijk does not specifically teach using a color converter.

However, Boerner does teaches a scintillator layer that emits radiation in a short wavelength (i.e. bordering the UV region around 400nm) and using a color-transforming layer to convert the emitted radiation to a wavelength more suited to the spectral sensitivity of the detector (abstract, ¶0008, ¶0016, ¶0017). Since the luminous color-transforming layer taught by Boerner relies on the basic teaching of photoluminescence (¶0023) wherein light of a higher energy (such as UV) to a lower energy (such as visible), regardless of the example that proceeds the invention encompasses

any range of wavelengths wherein the luminescence from the scintillator (higher energy) is converted to "the spectral-sensitivity" of the photodiode (¶0022). Thus, Boerner teaches that such a technique enables a larger part of the X-ray radiation to be used for image analysis (abstract).

Thus, it would be obvious for a person having ordinary skill in the art at the time the invention was made to provide a color-converting layer between the scintillator and the photodiode so as to convert the emitted radiation to a wavelength more suitable for the spectral sensitivity of the detector, thereby allowing a larger part of the X-ray radiation to be used for image analysis, as taught by Boerner.

Regarding claims 2 and 14-16, Eijk et al further teaches the scintillator compounds of YPO_4:Pr and Y_2SiO_5:Pr (Table 2), which are members of the claimed group with x=1.

Regarding claim 5, Boerner teaches the application of such a device for X-radiation detection (¶0008).

Regarding claim 11 specifically, Boerner teaches the converter layer working with an array of photodiodes (¶0022) wherein the color-converter is between the scintillator and the array of photodiodes.

Regarding claim 12, Van Eijk does not specifically detail the decay time for the scintillator being 9 ns, he does stress the importance of the decay time for various applications (page 664). The general condition of decay times for Pr^{3+} doped inorganic scintillators being taught by van Eijk (Table 2) it would be obvious to one of ordinary skill in the art at the time the invention was made to use a scintillator with a decay time of 9 ns since the discussed scintillator material comprises a downward trend from 20 ns to 18 ns to 14 ns making 9 ns obvious by routine experimentation.

Regarding claim 13, for similar reason to claim 12, it is obvious that, while van Eijk does not specifically detail the decay time for the scintillator being 16 ns, he does teach a range of decay times, 20 ns, 18 ns, and 14 ns (Table 2) for this scintillator that overlaps this value.

Regarding claim 20, the photoluminescent phosphor [color converter] can be organic or inorganic material (¶0027).

Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Eijk and Boerner as applied to claim 1 above, and further in view of Tonami et al (Tonami) US 5,909,029.

Regarding claims 7 and 8, the combination of van Eijk and Boerner disclose all the limitations of parent claim 1, as discussed above. Further Boerner allows for the color transforming luminous substance (¶0012-¶0013) to be incorporated in a polymeric layer between (¶0017) the scintillator and photodiode or in a separate layer between the scintillator and photodiode (¶0028). However, the combination is silent with regards to the color converter being a polymer light guide.

However, such combinations are known in the art. For example, Tonami teaches a detector for X-ray imaging using a scintillator **1** and a photodiode **2** (Figure 3). Tonami further provides a light guide, in the form of an array of optical fibers **4** between the scintillator **1** and the photodiode **2**. Tonami teaches that such a configuration prevents the dispersion of light in the lateral direction of the photodiode surface as well as serving to protect the photodiode elements during handling (column 3, lines 25-41).

Thus, it would have been obvious to a person having ordinary skill in the art at the time the invention was made to provide a light guide between the scintillator and the photodiode so as to prevent the lateral dispersion of light while protecting the photodiode elements during handling, as taught by Tonami. The incorporation of the color-transforming component suggested by Boerner

either as a dopant in the optical fiber plate or as a separate layer thereon would have been further obvious to one of ordinary skill in the art since polymer fiber optics are known in the art as are wavelength shifting dopants added thereto (see, for example, Anderson et al.)

Claims 14-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Eijk and Boerner as applied to claim 9 above, and further in view of Juestel et al. (Juestel) US 6,734,631 B2.

Van Eijk teaches the Pr_{3+} scintillator being comprised of the materials listed in Table 2 (pg. 666). However, Van Eijk fails to specifically detail a Pr_{3+} scintillator wherein the scintillator is $LaPO_4$:Pr, $LuBO_3$:Pr or $Ca_{1-2y}Li_2SiO_4:Pr_yNa_y$ where $0.001 \leq y \leq 0.2$.

Regarding claim 15 and 16, Juestel teaches a phosphor converting layer in the VUV range and has a high absorption coefficient (column 2 lines 8-10) that is selected from the group containing $LaPO_4$:Pr and $LuBO_3$:Pr (column 2 lines 21-24). It would be obvious for a person of ordinary skill in the art at the time the invention was made to use the material taught by Juestel with the invention taught by Van Eijk since the material taught by Juestel is a taught as an alternative to the YPO_4:Pr phosphor taught by Van Eijk and thus an obvious alternative.

Regarding claim 14, Juestel teaches that a suitable alternative to YPO_4:Pr (column 3 lines 48-50) is $CaLi_2SiO_4$:Pb (column 3 lines 41-44). While Juestel does not directly teach this host lattice being used with Pr and Na, it would be obvious to one of ordinary skill in the art at the time the invention was made to try such combination given the fact that Juestel teaches that the activator Pr^{3+} is a preferred activator (column 2 lines 5-7). Furthermore it is known in the art to use Na as an activator since this emits in the range of 430nm (Boerner, Table 1) which is required for PET applications as taught Van Eijk (Table 1) where it is clear that the wavelength emission must be greater than 300 nm (Van Eijk, Table 1).

Claim 17 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Eijk, Boerner, Juestel, and further in view of Tonami.

Regarding claim 17-19, Van Eijk teaches a method of imaging comprising receiving X-rays and low energy gamma rays [reads on: γ quantum] with a device for the detection of input radiation comprising a Pr^{3+} activated scintillator (Table 2, page 666), converting input radiation into UV radiation (Table 2 and Figure 3) and a photodiode to convert the optical signal form the scintillator into an electrical signal (top of first column of page 665), wherein the scintillator is used in a PET or gamma camera (i.e. SPECT) imaging system (Table 1 and first column of page 664), in which case the electric signal generated by the photodiode would be used to generate an image. Van Eijk does not specifically teach using a color converter or the lattice support for the Pr^{3+} scintillator being one of $LuCl_3$:Pr, $LuBr_3$:Pr, $(Lu_{2-x}Y_x)SiO_5$:Pr where $0\leq x\leq 1$, $(Lu_{1-x}Y_x)Si_2O_7$:Pr where $0\leq x\leq 1$, and $(Lu_{1-x}Y_x)BO_3$:Pr where $0\leq x\leq 1$.

Boerner teaches a scintillator layer that emits radiation in a short wavelength (i.e. bordering the UV region around 400nm) and uses a color-transforming layer to convert the emitted radiation to a wavelength more suited to the spectral sensitivity of the detector (abstract, ¶0008, ¶0016, ¶0017). Since the luminous color-transforming layer taught by Boerner relies on the basic teaching of photoluminescence (¶0023) wherein light of a higher energy (such as UV) to a lower energy (such as visible), regardless of the example that proceeds the invention encompasses any range of wavelengths wherein the luminescence from the scintillator (higher energy) is converted to "the spectral-sensitivity" of the photodiode (¶0022). Thus, Boerner teaches that such a technique enables a larger part of the X-ray radiation to be used for image analysis (abstract).

Thus, it would be obvious for a person having ordinary skill in the art at the time the invention was made to provide a color-converting layer between the scintillator and the photodiode so as to convert the emitted radiation to a wavelength more suitable for the spectral sensitivity of the detector, thereby allowing a larger part of the X-ray radiation to be used for image analysis, as taught by Boerner.

Juestel teaches a phosphor converting layer in the VUV range and has a high absorption coefficient (column 2 lines 8-10) that is selected from the group containing $LaPO_4$:Pr and $LuBO_3$:Pr (column 2 lines 21-24). It would be obvious for a person of ordinary skill in the art at the time the invention was made to use the material taught by Juestel with the invention taught by Van Eijk since the material taught by Juestel is a taught as an alternative to the YPO_4:Pr phosphor taught by Van Eijk and thus an obvious alternative (Juestel column 3 lines 48-50).

Regarding claims 18 and 19, the combination of Van Eijk, Boerner, and Juestel disclose all the limitations of parent claim 17, as discussed above. Further Boerner allows for the color transforming luminous substance (¶0012-¶0013) to be incorporated in a polymeric layer between (¶0017) the scintillator and photodiode [reads on claim 18] or in a separate layer [reads on claim 19] between the scintillator and photodiode (¶0028).

Response to Arguments

Applicant's arguments filed 06/01/2007 have been fully considered but they are not persuasive. It is noted that claim 1 as amended does not include all the elements of canceled claim 6. Claim 6 originally stated "a color converter which contains a luminous substance which can be excited by UV radiation is arranged **between** the sensor and the photodiode in the device." Claim 1 as amended does to include the limitation of the converter being between the sensor and the photodiode.

Applicant argues that Boerner only teaches light from the visible spectrum being converted to light of another color in the visible spectrum (page 10 lines 1-9 and page 13 lines 1-7). Even though the example given does indeed illustrate light being converted from blue to red (¶0023), this is merely an example, and it is the previous statement of this paragraph as well as the previous paragraph that is grounds for the rejection. Boerner teaches that the color-transforming layer transforms the light from the scintillator into a wavelength range, which corresponds to the spectral-sensitivity maximum of the photodiode [i.e. visible range] (¶0022). It is argued that a person of ordinary skill in the art using the color converter taught by Boerner (¶0017) in the application of X-radiation detection taught by Boerner (¶0017) would transform the color from a scintillator to the visible range. Since the color-converter taught by Boerner is being used with the scintillator taught by Van Eijk it would thus be necessary to convert the scintillating light from the Van Eijk scintillator [for YPO_4:Pr the wavelength range is 232-272 (UV), Table 2] to the visible range. Hence, the applicant's argument (page 10 lines 1-9) that the claimed color-converter does not which must be excited by UV is not taught in Boerner, fails to consider the application of the color-converter for X-radiation detection as taught in Boerner (¶0017), thus making it necessary to convert from the UV to the visible range.

Applicant argues with regards to claim 9 (all of page 11) that Van Eijk teaches away from the use of Pr^{3+} activated scintillator in a sensor used together with a photodiode, but instead teaches only that this material "could" be of interest. Furthermore applicant points out that Van Eijk teaches Ce^{3+} doped scintillators are better for use with silicon diodes since the sensitivity curves match. However, these arguments do not address the fact that Van Eijk teaches, "Up until now [1994] most attention has been paid to Ce^{3+} doped scintillators. However... Pr^{3+} doped materials cannot be excluded as fast, high light yield, scintillators a priori," (page 666) thus making it obvious to try.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jessica L. Eley whose telephone number is (571) 272-9793. The examiner can normally be reached on Monday - Thursday 8:00-6:30 EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Dave Porta can be reached on (571) 272-2444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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